



2050

Heat Roadmap Europe

A low-carbon heating and cooling strategy

FORECAST Guide for Lead-Users

Understanding heating and cooling data
for 2015 and 2050

Summary Report

Deliverable 3.5

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Introduction

In Europe, there is a clear objective to decarbonise the energy system, but it is currently unclear how to achieve this in the heating and cooling (H&C) sector. The Heat Roadmap Europe 4 ([HRE4](#)) project enables new policies and prepares the ground for new investments by creating more certainty regarding the changes that are required to achieve a proper H&C transition. By increasing H&C lead-users' capacities at local to EU levels via the development of key tools and methodologies, the impact of efficient measures on both the demand and supply sides of the H&C sector can be quantified and eventually realised.

This document aims to facilitate lead-users (i.e. policymakers, industry and researchers) to access and better comprehend how certain HRE4 results can benefit them. FORECAST itself is a tool which presents the most currently-available (2015) H&C profiles (see D3.1 of WP3 for more details), in relation to a baseline for H&C demand through 2050.

In other words, FORECAST provides insights into how we use H&C today in Europe, as well how H&C might plausibly operate only a few decades from now, for better or worse.

This guide is based on results from other deliverables including the heating and cooling profiles for 2015 (D3.1) and the baseline scenario for delivered heating and cooling demand in 2030 and 2050 (D3.3 and D3.4). More detailed information can be found in the respective deliverables.

Key messages drawn from FORECAST

1

Having a complete picture of H&C demand and supply in Europe, even down to a country level, is crucial for developing effective transition strategies and policies at the levels of the EU and its individual member states.

FORECAST results provide unique added value, since its 2015 profiles provide consistent end-use energy balances for H&C, even on a national level, and they present a degree of detail not available from Eurostat or from any other source.

Because the FORECAST data is so comprehensive, the 2050 baseline for H&C demand is the most detailed long-term baseline available anywhere today, containing numerous technological characteristics, specific assumptions and actionable results.

2

Though electricity generation is often prioritized over H&C in many countries, decision-makers should not neglect H&C. In fact, H&C should make up a core component of any long-term strategies for sustainable energy system transitions.

This need to focus on H&C becomes immensely clear when it is realised that, of the EU28's total final energy demand (FED) from all sectors in 2015 (12.606 TWh), approximately half of it arises just from H&C needs of the industry, residential and tertiary sectors (see Figure 1 below), much more than for any other single demand-sector. In fact, this is not just a European phenomenon, since a similar situation is revealed in the FORECAST data from individual EU member states as well.

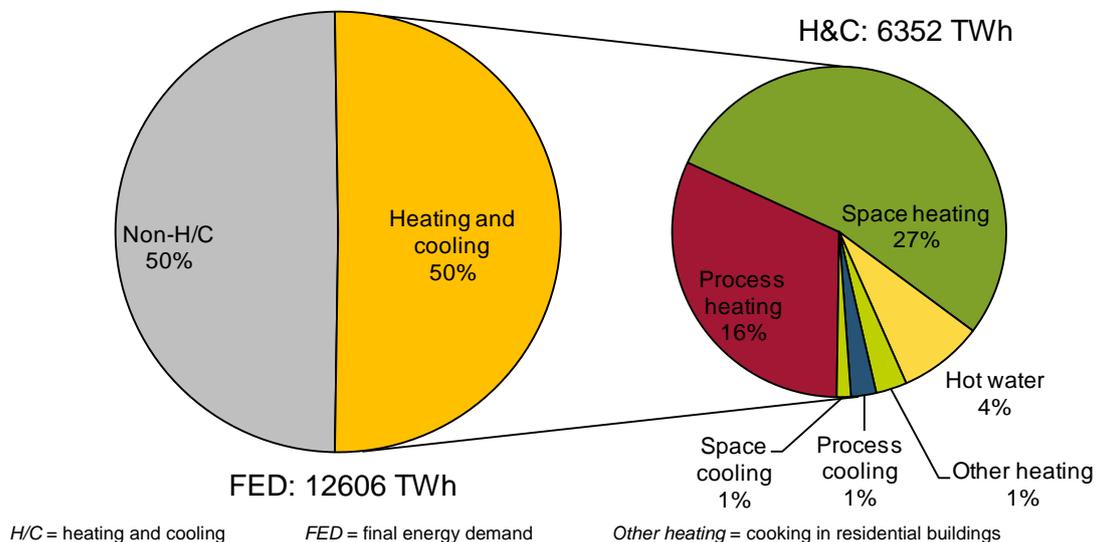


Figure 1: Total FED from all sectors, compared to the calculated H&C demand in 2015 from industry, residential and tertiary sectors in the EU28, by end-use

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Since fossil fuels, especially natural gas, cover two-thirds of H&C in the EU28, decision-makers each have their own role to play in facilitating the significant improvements needed to decarbonise the entire H&C sector.

Luckily, HRE4 already has many viable solutions to offer, and tools to enable them, which can empower decision-makers to institute effective measures which make possible great benefits to the environment, economy and health of European communities.

FORECAST results (e.g. Figure 2 below) provide a robust quantitative basis for planning out effective H&C transformations of relevant (sub-)sectors to make use of not only more efficient centralised and decentralised systems, but also taking advantage of renewable and alternative sources, often already near to those sites of greatest H&C demand.

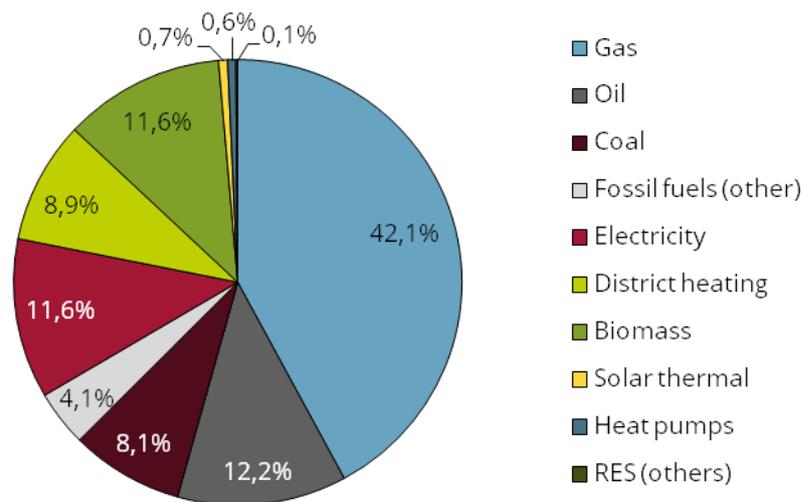


Figure 2: H&C-FED in 2015 in the EU28, distinguished by energy carrier inputs

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Though future trends cannot be perfectly predicted, what is certain is that the H&C sector cannot afford stagnation in transforming towards a sustainable H&C system.

HRE4 results already shed light on feasible pathways by providing valuable starting points to figure out how today's H&C systems are able to not only align with expected developments, but actually perform better than business-as-usual tendencies.

Assuming current policies and trends, FORECAST scenarios can already predict important shifts in demand dynamics that should be integrated into planning:

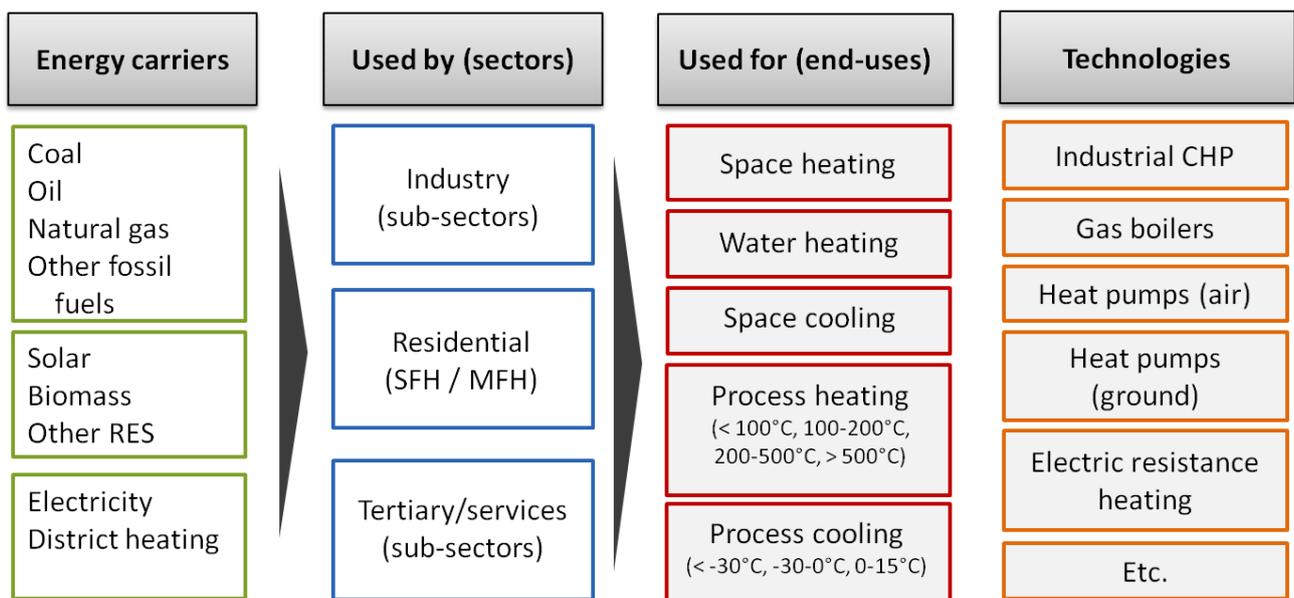
- Space heating demand will continue to fall – driven largely by improved building standards and more efficient heating technologies across the EU28.
- Space cooling demand will substantially rise by 2050 – due to more floor area requiring cooling (e.g. higher comfort requirements in residential and tertiary sector buildings), especially in light of the warmer temperatures expected to arise from climate change.

Why is FORECAST important?

The FORECAST results are used for the profiling of 2015 H&C demands and for the calculation of a possible baseline evolution up until 2030 and 2050.

Conventional energy balances (both national and from Eurostat) generally provide the total FED split only along main sectors (i.e. industry, residential, tertiary/services and transport), as well as industrial sub-sectors (but not from other main sectors), and a few different types of energy carrier inputs. Unfortunately, they usually do not provide information on end-uses such as heating, cooling, mechanical energy or useful energy (i.e. the heat that is used by the consumer, e.g. for heating a room).

The FORECAST approach improves upon such traditional data methods to break down H&C demand profiles according to very useful divisions by energy carriers, sub-sectors, end-uses, temperature levels and technologies (see Figure 3 below) for all fourteen countries¹ targeted by HRE4. FORECAST takes advantage of a unique dataset to provide lead-users with a viable starting point for effectively disaggregating detailed H&C demand baselines through 2050.



RES = Renewable energy sources, SFH = Single-family house; MFH = Multi-family house, CHP = combined heat and power

Figure 3: Overview of disaggregation of H&C profiles (based on Fraunhofer ISI, et al. 2016)

¹ Though many insights ought to be applicable across Europe, HRE4 especially focuses on those fourteen member states with the highest H&C demands: Austria, Belgium, Czech Republic, Finland, France, Germany, Hungary, Italy, the Netherlands, Poland, Romania, Spain, Sweden and the UK.

The H&C demand baseline for residential, tertiary/services and industry sectors provides a similar level of detail as the 2015 profiles. It depicts the business-as-usual evolution that is likely to occur based on currently-implemented policies and current economic trends that are projected to continue through 2030 and 2050. The baseline can then be used as a credible counterpoint useful for comparing with more pro-active scenarios, thereby revealing how HRE4 solutions could effectively lead to better decarbonisation transitions.

How does FORECAST work?

FORECAST's 2015 H&C profiles provide a detailed picture of today's H&C use in the industry, residential and service sectors. They help answer questions about how H&C is used, as well as where it already is, and is not (yet), relevant. Furthermore, the profiles also show which types of energy inputs (e.g. electricity, natural gas, biomass, etc.) are used to supply the identified H&C demands for each (sub-)sector. Such a consistent set of data and practical figures means that the detailed 2015 profiles provide a solid understanding of the status-quo for European H&C and hints at where the (sub-)sectors may end up in the future.

Meanwhile, the 2030 and 2050 baselines show possible evolutions of H&C demand in order to grasp how future demand might change, assuming the continuation of current trends and business-as-usual policies. Admittedly, such scenarios can often be quite uncertain since they depend on multiple inputs: reliable assumptions (e.g. industrial production, energy prices, etc.), the future projection of past trends and the use of established reference scenarios (i.e. EU Ref 2016). Nonetheless, the models being developed by HRE4 rely on credible criteria, and are already starting to shed light on not only expected developments, but also may even suggest potential pathways for improving upon the status quo.

Who should use FORECAST?

FORECAST outputs are most immediately applicable for relevant policy-makers, planners and other authorities in all fourteen HRE4 countries. There are likely to be many further beneficial insights for other countries to be drawn from FORECAST results as well. In any case, the results of this powerful tool may prove useful for whichever lead-users are working to transform the H&C sector, whether of individual nations or of the EU at large.

Regardless of the country context, it is nonetheless still important that decision-makers and other users keep in mind the following caveats:

- The calculations are done based on EU-wide datasets, which allows the generation of a consistent set of results for valid country comparisons. However, this also means that the data used in FORECAST might deviate from other/country-specific sources, which may or may not be more accurate than the EU datasets actually used – at the time of the modelling exercise, Eurostat’s FED dataset for 2015 was not yet available for calibrating FORECAST model results.
- The degree of certainty in FORECAST’s 2015 profiles varies between the segments. For example, values for the use of natural gas, coal and oil for heating are relatively robust. On the other side, data disaggregating service sub-sectors, the end-use of (specific) renewable sources for H&C, the use of electricity for H&C purposes and general data on space cooling each remain somewhat uncertain.
- Since the baselines through 2030 and 2050 are based on multiple assumptions, which likely cannot be adequately controlled by any model, HRE4 does not claim that these scenarios are predictions of what the future will definitively look like. Instead, the FORECAST baselines should rather be regarded as plausibly resembling the future, in many respects a future which HRE4 seeks to alter by inspiring more progressive transformations in the present.



Figure 4: Scenario-thinking creates a set of plausible futures from a vast range of options (JRC, 2017)

What are FORECAST’s main benefits?

Designing a policy mix to transform the H&C sector requires knowledge about both current end-uses and energy inputs for multiple (sub-)sectors, as well as the implications of such tendencies

into the future. In fact, similar results to those found in FORECAST's 2015 profiles have already been used intensely for such purposes, for example by the European Commission to propose an EU-wide strategy for H&C.

Such in-depth data provides a valuable starting point for developing legitimate national scenarios. These in turn could be used to calculate the impact of potential policy instruments and thereby guide the informed development of more effective strategies.

Furthermore, the stringent use of the same methodology across all countries make FORECAST results inherently consistent – this often is not the case when gathering data only from national sources where different methodologies are utilised, making valid, cross-country comparisons difficult to realise in practice. Such consistency means that FORECAST scenarios can be directly compared to each other, which means that it may be used to more readily identify suitable policy-making and other solutions from other countries which may have a realistic potential for replication/adaptation.

How does FORECAST fit in with HRE4 outputs?

This summary report has been designed specifically to complement other HRE4 outputs, not only those from the same work package (WP3), but also as vital components feeding into key deliverables from other WPs.

- The Peta4 maps (WP2) are actually calibrated to FORECAST's 2015 H&C demand profiles on an end-use level. This means that, for example, the total demand for space heating of a country is extracted from FORECAST and then allocated to that country's Peta4 maps and regions using a defined distribution key.
- FORECAST can be effectively used in combination with the cost-curves as a counterpoint (WP4). While the baselines forecast what will happen based on current trends, the cost-curves show the H&C demand saving-potential beyond the baselines, as well as the costs related to exploiting them.
- Finally, the H&C demands for individual end-uses (e.g. residential space heating and hot water, or process heating in industry) from FORECAST's 2030 and 2050 baselines are an input into the JRC-EU-TIMES model (WP5), which is intended to develop an overall energy system baseline through 2030 and 2050.

